

June 19, 2006

TO: D. Morris

FROM: S. Chhan

SUBJECT: SELENE Supportability Study

The Resource Allocation Planning Service (RAPS) has completed a study to analyze the SELENE Mission supportable by DSS-54 in Madrid and DSS-24 in Goldstone. The duration of this study is 30 days beginning after launch plus 40 days (L+40), which is from August 26 through September 25, 2007. This study assumes that the launch date is July 17, 2007, and will focus on the weeks with low supportable percentage less than 80%. The requirement from SELENE Mission was to add an additional 8 hour pass per day on either DSS-54 or DSS-24 to determine any impacts to other DSN Users.

The study compared the SELENE Mission supportable from DSS-54 and DSS-24 antenna separately and combined to see if there is any difference. The study also looked at viewperiods of other missions and events that may contribute to the low supportable percentage of the SELENE Mission.

In order to meet the SELENE Mission requirements of 7 pass per week at 8 hours per pass, the User Loading Profile was amended for DSS-54 and DSS-24 due to viewperiod durations ranging from 7-14 hours. Combining the two antennas (DSS-24 and DSS-54) will cover the SELENE Mission requirement; this is the recommendation from RAPS.

Summary of Results

An analysis and comparison of the supportable percentage of SELENE Mission on DSS-54 and DSS-24 was examined with both the antennas together and each antenna individually to determine if there was any difference at each location in Madrid and Goldstone. The overall analysis resulted in excellent supportability from DSS-54 and DSS-24 combined rather than using DSS-54 or DSS-24 individually.

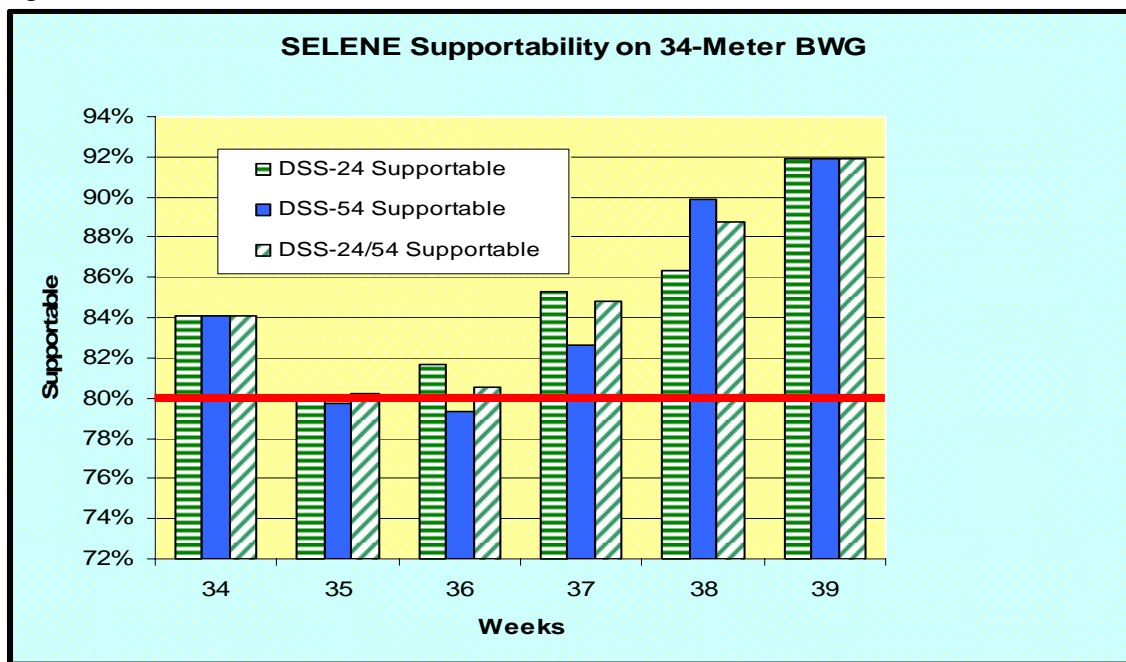
There was a past study for SELENE Mission dated August 23, 2005 by S. Guduru assessing the DSN's supportability of two launch date on July 1, 2007 or February 1, 2008 and at the time the report was generated, it recommended to the Mission to launch on the later date because of higher supportable percentage and less contentions. The study also indicated that SELENE Mission had days when viewperiods were less than 8 hours at each complex (MDSCC, GDSCC) during the requested launch opportunity.

This study examined the low supportable percentage for SELENE Mission below the 80% mark with both DSS-54 and DSS-24 together and separately from weeks 34 - 39. Overall the supportability percentage is very positive for the entire duration of the weeks in this study.

The low supportability in weeks 35 and 36 are due primarily for the following factors and contentions of events that are simultaneously occurring on DSS-54 and DSS-24:

- DSS-63 scheduled downtime for hydrostatic bearing replacement causing other DSN Users to seek alternative resources such as DSS-54 and DSS-24.
- Ulysses Mission and the Nutation activity heavy requests for the DSS-54 and DSS-24.
- Phoenix Mission launch support and trajectory correction maneuvers requiring DSS-54 and DSS-24.
- Chandra Mission requirements for the 34-Meter BWG1.
- SOHO Mission keyhole events requirements for DSS-54 and DSS-24.
- WIND Mission events requirements for DSS-54 and DSS-24.
- STA / STB Mission prime events and activities requirements for DSS-54 and DSS-24.

Figure 1: SELENE Supportability on 34-M BWG1 for Weeks 34-39, 2007.



For week 34 the average supportability from DSS-54 and DSS-24 both together and individually are above 82% compared to week 35, where the supportable percentage is slightly below the 80% mark. In week 36, DSS-24 and DSS-54 individually has a supportable percentage just below the 80% mark. Both of these results are due to viewperiod overlap with other missions; please see Figure 2 and 3 below. For weeks 37 and 38 it appears to have lower supportability from the combined resources of DSS-24 and DSS-54 versus the individual antenna because of the ULP had lower requirements for those weeks for individual antennas. In week 38, DSS-54 supportability was 90% as compared to both DSS-24/54 of

89% because the ULP for DSS-54 was only four pass per week compared to the combined DSS-24/54 of 7 pass per week. Similarly, week 36 and 37 had the same effect.

Figure 2: SELENE (MOON) Viewperiod overlaps with other DSN Users for Year 2007 week 35.

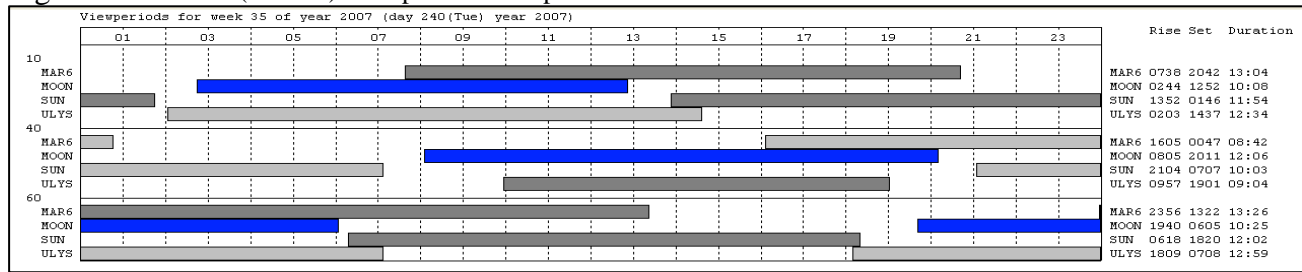
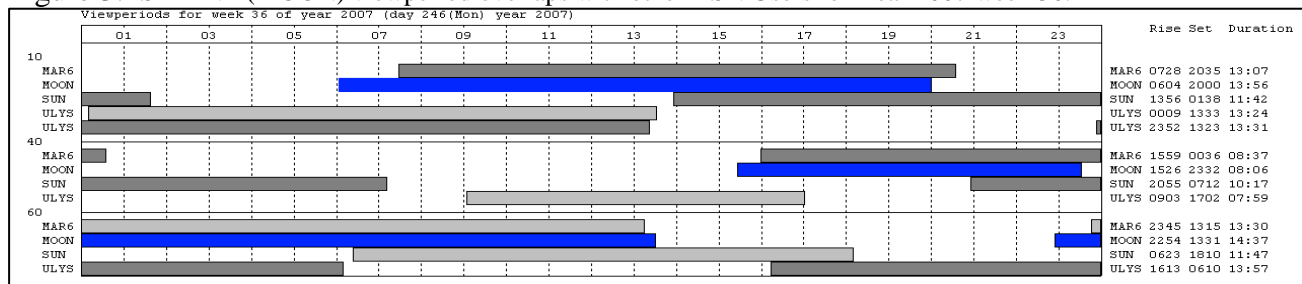


Figure 3: SELENE (MOON) viewperiod overlaps with other DSN Users for Year 2007 week 36.



There was a dip in supportable percentage for weeks 35 and 36 because of the SELENE viewperiods represented by MOON overlaps with ULYS, MAR6 (Mars 6 degree horizon mask), and SUN. The viewperiods duration in hours for SELENE Mission is similar at Goldstone (DSS-24) and Madrid (DSS-54) but varies at Canberra (not included in study).

For week 35, the viewperiods overlap with ULYS is 100% because nine hours of total Moon views was completely overlapped with ULYS (9/9 hours), MAR6 of 40% (4/9 hours) and none with SUN. The viewperiod overlap increased from 40% to almost 90% (8/9 hours) between MAR6 and MOON, but decreasing from 100% to 70% (6/9 hours) for ULYS, and the viewperiods for SUN remained unaffected by the end of the week.

For Week 36, SELENE viewperiod overlap about 90% (13/14 hours) with MAR6, 50% (7/14 hours) with SUN, and 60% (7/14 hours) with ULYS. For the duration of week 36, MARS viewperiod overlap with MOON decreased to 70% (10/14 hours), SUN overlaps increased to 90% (11/14 hours), and ULYS overlaps decreased to 20% (3/14 hours).

For Weeks 37, SELENE viewperiods decreased overlap with MAR6 from 60% (7/12 hours) to 25% (2/8 hours), and overlap with SUN also decreased from 90% (11/12 hours) to 60% (5/8 hours), and ULYS overlap increased from 25% (4/12 hours) to 75% (6/8 hours). The increased in viewperiod overlap with ULYS can be noted due to less view towards the end of week 37.

The viewperiod in hours for week 35 range from 9 hours to 13 hours in duration from beginning of week to end of week, both at Goldstone and Madrid and 1/4 less views at Canberra. For week 36, viewperiods range from 14 hours to 13 hours for both Goldstone and Madrid, but still about 1/4 less in Canberra. For week 37, the average viewperiod for Goldstone and Madrid range from 12 hours to 8 hours, but Canberra starts to pick up more view with 10 hours to 13 hours.

Conclusion

Forecast results for SELENE Mission indicates that using both DSS-54 and DSS-24 to support their requested eight hour pass will enhance supportability versus putting the pass alone on DSS-54 or DSS-24. The only issues that may arise are from new requirements from other DSN users in the near future. However, the study found a high level of contention between SELENE and other DSN users especially during the DSS-63 downtime for hydrostatic bearing replacement which shifts users to DSS-54 for support.

Another factor causing lower supportable percentage for SELENE Mission in week 35 and 36 is primarily the viewperiod overlaps with MAR6, ULYS, and SUN views. SELENE Mission supportable improved because the MAR6 viewperiods overlaps was reduced towards the end of week 36. The supportable percentage is positively above 80% mark for the remaining timeframe of the study.

For SELENE to have better supportability percentage, the eight hour pass can be shortened to the minimum of 4 hours per week or reduce the number of pass per week for the weeks with the lowest percentage of supportability, this is especially critical in weeks with high contentions for the DSS-54 and DSS-24. Otherwise, scheduling around those weeks with the lowest supportability will result in the best support from the DSN 34-Meter BWG1.

RAPS recommend reducing the number of pass per week on the weeks with low supportability percentage, and also the hours per pass could be shortened to obtain a higher supportable percentage. In addition, it is recommended to support the SELENE Mission with both DSS-54 (Madrid) and DSS-24 (Goldstone), instead of just a single antenna; this will ensure that the SELENE Mission viewperiods are sufficiently covered. The weeks for SELENE Mission to work around or simply to reduce the hours of support are in weeks 35 and 36 because of high viewperiods overlaps. Another recommendation from RAPS is to schedule the SELENE Mission pass on those weeks with the highest supportability percentage and utilize the required hours necessary to accomplish SELENE Mission requirements.